MISSOURI BOTANICAL GARDEN

Bulletin

January 1960
Volume XLVIII
Number 1

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THE CHARLES DARWIN YEAR

Featuring an article by Dr. F. W. Went about insectivorous plants. Mr. Darwin also was very interested in these plants and contributed much to our early knowledge of carnivory in the plant world.

COVER: Camellia japonica

The first Curtis Camellia Plate. Single-flowered Camellia illustrated in the Botanical Magazine, Plate 42, March 1788.

Camellias named for George Joseph Camellus, a Moravian Jesuit who traveled in Asia in the 17th Century, belong to the Tea Family of plants, Theaceae. The flowers either single or double are white, pink through to rich red. The doubles attain a symmetry of form near perfection. These plants are tender north of plant zone 6.

The time of flowering is primarily in January and February. You can see a beautiful display of the more common varieties now in the Linnean House of the Missouri Botanical Garden.

CONTENTS

Plants of Prey
The Darwin Controversy
Caring for Christmas Plants
Ivy Vine or Bush
Tower Grove
Archeological Cucurbits
Book Review
Missouri Botanical Garden Programs

Office of publication: 306 E. Simmons Street, Galesburg, Illinois.

Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis 10, Missouri.

Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $2.50 a year.

Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under Act of March 3, 1879.

Missouri Botanical Garden Bulletin

Vol. XLVIII No. 1 January 1960

PLANTS OF PREY

DR. F. W. WENT

WHEREVER one investigates plants, and whatever observations are made, they always are interesting. Yet some plants are more spectacular, and others are more amazing when viewed from a human standpoint. Among the latter the carnivorous or insect-eating plants take first place, but let me state at the outset that there are no plants able to catch and digest any animal larger than a cockroach. Man-eating plants only exist in the realm of fiction.

Charles Darwin was equally versed in botanical, zoological and geological problems. If he had not published his evolutionary theory, for which every man and child knows him, he would be held in equal esteem by the scientific world for his work on coral reefs, fertilization of flowers, movements of plants, the means of distribution of plants and animals and many other subjects. For example, he was the discoverer of carnivory in plants. His eye and mind were always on the alert, which was partly responsible for his phenomenal achievements. Thus he tells himself, "In the summer of 1860 I was idling and resting near Hartfield, where two species of *Drosera* abound, and I noticed that numerous insects had been entrapped by the leaves. I carried home some plants, and on giving them insects saw the movements of the tentacles, and this made me think that the insects were caught for some special purpose." He found that these movements were caused by nitrogenous compounds, and that digestive enzymes dissolved the insect. Darwin relates: "During subsequent years, whenever I had the leisure I pursued my experiments and my book on 'Insectivorous Plants' was published in July 1875. The fact that a plant should secrete, when properly excited, a fluid containing an acid and ferment closely analogous to the digestive fluid of an animal, was certainly a remarkable discovery." During his work with the sundew, *Drosera*, Darwin became so excited that he wrote the father of Botany in the United States, Asa Gray: "You are unjust on the merits of my beloved *Drosera*, it is a wonderful plant, or rather a most sagacious animal. I will stick up for *Drosera* to the day of my death."

There is no doubt that many carnivorous plants digest their prey, and grow better when their diet of mineral salts is augmented with meat. But it also has been shown that they can live and grow without trapping insects. What does the meat do to them. To answer this, we must realize that all meat-eaters among plants grow in peat bogs or swamps, which, generally speaking, are places with a very poor

nitrogen and nutrient supply of the soil. It seems likely that these plants do not use their digested prey as a source of protein, but merely as a source of nitrogen and other nutrients. If this is true they would do the same things as the ant-plants, only in a more elaborate way. Many of the plants which furnish room (and sometimes board) to ants profit from the refuse of the ants, through uptake of the nutrients it contains. The insect eating plants are less subtle, they trap or grab their prey, and decompose it to get at the nutrients. This in itself is an interesting fact, but more interesting is the way insects are caught. For a review of these methods we do best by turning to the delightful book, by the late Professor Francis E. Lloyd, entitled, "The Carnivorous Plants." With fine humor, seldom encountered in scientific books, he places the insect-catching plants in six major groups: pit-falls, lobster pots, snares, fly-paper traps, steel traps and mousetraps. The simplest device is the pit-fall. In northern California a typical example grows, *Darlingtonia* or the cobra plant. In the South, e.g. in the Carolinas and Georgia, another example of the type is found, *Sarracenia*. Each leaf is rolled into a tube-like pitcher, which is twisted at the top so that the entrance to the pitcher points downward. Around its mouth the margin is bent inwards and lined with retrorse stiff hair so that insects which entered the pitcher cannot crawl out again. They are attracted by a violet-like odor. There is no lid which closes with a catch, it is not a trap but a pit. Inside the pitcher some water is always present, but after a prey is caught, there is a 3–10-fold increase in its contents. *Darlingtonia* does not excrete to digest the prey, for this it depends on bacteria.

OLD M.B.G. PHOTO

Sundew *Drosera brevifolia*

Sometimes these plants overeat. Their pitchers get filled with dead insects, which start to rot and kill the leaves. I have seen one or more cockroaches trapped in pitchers in the greenhouse, but they gave too rich a brew, and the pitchers disintegrated, together with their catch. In some Botanical Gardens the pitcher plants have to be protected with screens, since they seem too attractive for insects. And no wonder, for *Nepenthes,* an Asian genus of pitcher plants, produces nectar in its traps.

"Without telling more about the wonders of the pitcher plants, and skipping the lobster pots and snares, the fly-paper traps need our attention. The best known plant in this group is the sundew, *Drosera.* It grows in peat bogs all over the world, and is very common in the north and east of our country. The small plants consist of a rosette of leaves with a graceful flowerstalk carrying several white flowers between them. Each leaf is covered with glands sitting on long stalks, resembling tentacles. These glands secrete a sticky slime so that any small insect which comes in contact with the slime, sticks to it. Then the tentacles surrounding those holding the insect fold inward over the prey, which thus is pressed against the leaf, and digested by an enzyme. Not only insects, but also small bits of egg white or meat are accepted and digested. This is a fascinating thing to observe, and it can easily be seen in plants brought home from a peat bog.

The Venus fly trap, *Dionaea,* occurs in the Carolinas and is an example of

PHOTO BY E.L.E.

Venus Fly-trap *Dionea muscipula*

the steel trap. In size and general build the plant resembles a sundew, but the roundish leaves are hinged and can fold upwards along the middle. On the inside of each valve three hairs stand. When these are touched twice the trap closes suddenly. Since the margins of the leaf have teeth, which mesh when closed, any insect unfortunate enough to touch the sensitive hairs while walking on the leaf will be enclosed by the two valves, and escape is impossible because the teeth form the bars of a cage. On the inside of the valves glands excrete a digestive fluid, and in a few days only the indigestible skin of the insect is left. Then the leaf may open again, to trap another insect. On warm days the closing movement of the trap is so fast that a comparison with a steel trap is very apt. It takes less than a second to close when the temperature is high, but on cool mornings the trap may not close at all after stimulation.

A particularly interesting detail is that only upon a double stimulation of the sensitive hairs the trap closes. One single hair must be touched twice in a few seconds interval, *or* two different hairs can be touched once each, also with a short interval. Therefore a little pebble or inanimate object cannot cause closure, but an insect walking between the hairs is most likely to make two touchdowns, and become trapped.

Another plant having similar, but simpler traps is a water plant, *Aldrovanda*. This forms a long stem with whorls of leaves, each surmounted by a tiny trap.

The mouse trap mechanism of trapping is represented by the bladderwort. *Utricularia*. Almost 300 species are known, most of them living in water. Their yellow flowers are delicate, or sometimes showy, but of greatest interest are their traps. They are quite small, usually not more than a few millimeters. Professor Lloyd has studied them in detail and most of what we know about their astounding mechanism is due to his researches. The trap consists of an almost round

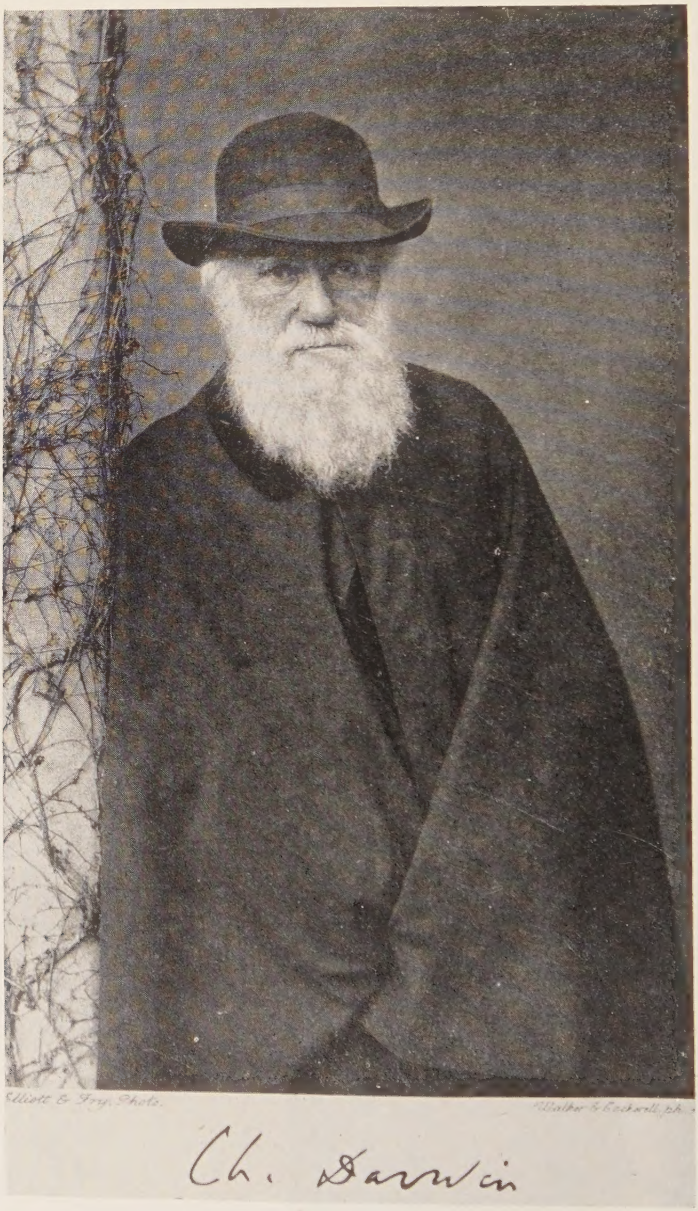
REPRINT OTTO LUGGER
Bladderwort *Utricularia sp.*

sac, with one small opening, closed by a door or valve. This is not a passive check valve, which has to be pushed open by the prey and falls shut behind it, but a door which closes tightly against a sill, preventing it from opening. Water is pumped out of the bladder, and, since the door is hermetically closed, the sides of the bladder are pulled inward and a tension is developed inside. On the outside of the door are a few sensitive hairs. When they are touched the door gives and water is sucked into the bladder with great rapidity. Any small animal (usually a *Daphnia* or similar crustacean) is caught in this rush of water, and within one-tenth of a second the trespasser is inside the bladder. The door closes again, enzymes are excreted, and the prey is digested.

The carnivorous plants belong to seven different families. It is remarkable how, in the course of evolution, meat-eating habits are developed in those seven separate families. Not only mechanism for digestion and absorption of the nutrients from the prey had to be evolved, but equally, in each family individually important mechanism to lure and catch the prey had to develop. One without the other would have been useless so that we have to conceive that the digestive, luring and catching mechanism all developed simultaneously.

Pitcher Plant *Nepenthes dominii*. Traps developed on tips of leaves and contain nectar.

Photo by G.H.P. M.B.G. BULLETIN Vol. 38:2. p. 29.


Elliott & Fry, Photo.
Walker & Boutall, ph.
Ch. Darwin

THE DARWIN CONTROVERSY

Momentous Book on Evolution Has Its Centennial

SAM LAMBERT

One hundred years ago, on November 24, 1859, a momentous book appeared in England. It sold out its first edition of 1250 copies in one day and started a thunderous controversy that is still felt in some degree. The book, bearing the lengthy title "On the Origin of Species by Means of Natural Selection," was written by Charles Darwin. His thesis—that plant and animal life emerged from lower forms of life rather than having been created directly—challenged literal interpretation of the Book of Genesis and shattered the complacency of the Victorian world. Also, it opened to general critical study the origin of man and his relation to nature.

Darwin's epochal book had its beginning some 25 years earlier when, as a young naturalist, he made a five-year scientific voyage aboard the Royal Navy brig *Beagle* to South America and the islands of the Pacific. From his observations of plant and animal life in the many places he visited, Darwin was struck by the possibility many species had evolved from a common source. He explained this evolution by natural selection—that infinite variations among plants and animals sometimes result in characteristics that are transmittable through heredity and that are an advantage in the constant struggle for existence. The fittest survive, he concluded, and the result is a continuing development of a higher form of life. The implication that man also evolved from a lower form was spelled out in 1871 in "The Descent of Man."

After returning to England from his voyages aboard the *Beagle*, Darwin married his cousin, Emma Wedgwood, in 1839. They moved to a big country home, Down House, in Kent and raised a large family. There he continued his scientific studies, became acquainted with the views of the English economist Malthus, the philosopher Herbert Spencer, the geologist Lyell, and the French naturalist Lamarck.

Darwin kept his theories on evolution largely to himself until 1858, when he saw them mirrored in a manuscript by Alfred Wallace, a young British naturalist. This led to the joint presentation, at a science meeting, of their work. However, the documentation and style of the "Origin of Species," published the next year, was responsible for the theory of evolution being linked with Darwin's name.

Unfortunately, many of Darwin's generalizations were overemphasized and the term "Darwinism" came to be used to justify, among other things, cut-throat competition and a callous social outlook. Darwin himself was open-minded and humble about his views. Personally, he was not anti-religious, once remarked that the universe was too complex to have arisen "through chance."

Reprinted from *St. Louis Post Dispatch*, Sun., Nov. 22, 1959

CARING FOR CHRISTMAS PLANTS

A WALK through a greenhouse where plants are being readied for Christmas is a delightful experience. The plants look so fresh in the bright sunlight and you are conscious of the warm, moist air all about. Now step into the modern home where these plants are used for holiday decorations or arrive as gift plants. If plants could talk, can't you just hear them complaining of their discomfort in the hot, dry, stuffy atmosphere of the home? While they are silent none-the-less their actions are louder than words. The one plant that reacts almost immediately to the sudden change in environment is the popular Christmas *Poinsettia.* Knowing this, every effort should be made to treat it well. Try and select a cooler location in the room free from drafts, but where there is plenty of daylight. Never let the plant dry out and yet do not overwater it. When a pot of brilliant red *Poinsettias* is brought to the home the plants are in prime condition. They flourished under the best growing conditions in the greenhouse and have developed their bracts since mid-November. In December they were fully grown and had they been left in the greenhouse would have remained in prime condition for six to eight weeks or longer In the dry atmosphere of the home *Poinsettias* will be good for about a week and after that will begin losing the lower leaves and some of the bracts. Unfortunately, that ends their attractiveness as a house plant. It is possible to grow them again the following year, but it takes time and care and that is another story.

Some other colorful red and green fruited plants are the Jerusalem cherries, and peppers. The cherries and peppers are not so quickly affected by temperature changes and remain in good condition for a longer time. They are annuals and are grown from seed each year. After the fruits have shriveled or dropped the plants may as well be discarded. The seed can be saved and used to produce new plants.

Kalanchoes in shades of rich red and orange bloom for a long time and, being succulents, they easily adapt themselves to the dry environment of the home. They are good, colorful, long lasting Christmas plants.

Cyclamen can be kept beautiful by growing them where it is cool and by giving them plenty of moisture. This will also keep them blooming for a long time. They have interesting

PHOTO BY P.A.K.

Cyclamen

leaves and even after they have stopped blooming are still very attractive plants.

Azaleas also like to be cool and moist. If these conditions are met they will bloom for several weeks. On a sun porch they can stand temperatures between 35 and 40 degrees and if such a location is available that is the best place to keep the plants until they can be taken outdoors in a semi-shaded spot during the spring and summer months. While outdoors feed them at monthly intervals, alternating ammonium sulphate with a soluble fertilizer. The plants must be brought indoors before the first frost and will bloom again in February and March.

African violets, Begonias, Gloxinias, Chrysanthemums and foliage plants like Philodendrons, ivies, Ficus, Bromelias and hollies are just a few of the many plants available for Christmas. Regardless of the kind of plant, the essentials for good growth are moisture, light, proper temperature and a regular feeding time.

How often a plant should be watered is a puzzling question frequently asked and one for which no satisfactory answer can be given. So much depends upon the kind of plant, the type of container, the humidity or air and the soil in which it is planted. Cacti and succulents need less water and can endure longer intervals without water than plants like ferns and *Azaleas*. If there is little space for water because the plant has been potted high, one watering will not suffice and will moisten only the surface soil. Such a plant had better be set in a pan of water and left there until the entire root ball has been moistened. Plants will dry out faster on cold days because more heat is circulated in the home. On mild, damp days there is little need for heat and there is a corresponding decrease in the water requirements of the plants. Every effort should be made to increase the humidity near the plants by placing them in saucers of damp sand, gravel or peat. Plants on a windowsill usually do not dry out as fast as those in the room.

Plants need good light, but they vary in their light requirements, flowering plants needing more than foliage plants. Some plants, like African violets, can be grown without daylight and thrive just as well under fluorescent lamps.

High temperatures and low humidity will ruin most plants. If it is impossible to avoid such conditions some kinds of plants may be grown in plastic or glass enclosures, referred to as wardian cases, where humidity can be controlled. PAUL A. KOHL

PHOTO BY P.A.K.
Gloxinia

IVY VINE OR BUSH

Plants that we think of normally as being vines attain a new interest when we find we can grow them as shrubs. There are a number of vines which produce a low arborescent or bushy type of growth and as such can be used for accent or specimen plants, tub or pot plants or even hedge rows. Certain vines will become bushy or tree-like by special training; some grow this way after removal or loss of their accustomed support; more often the condition occurs when a plant reaches a state of maturity and takes a bushy form in order to place its flowers and fruits more advantageously for pollination and seed dissemination. Examples of these phenomena of plant behavior are (1) Wisteria *(Wisteria floribunda)*, (2) poison ivy *(Rhus toxicodendron)* the bush form of which is known as "poison oak," and (3) the evergreen groundcover vine English ivy *(Hedera helix)*.

The English ivy, and the various strains, named for locations where this plant has adapted itself to climatic conditions such as Bulgarian, Roumanian and Scandanavian, is an interesting evergreen when used as a shrub, either separately or in conjunction with the vine form as a ground cover. The shrub form, or sexually mature state of the English ivy, comes about at a dramatic point when age, conditions of growth or some unknown stimuli cause this plant to change its style of growth. Instead of a creeping vine it now becomes bushy with sturdy branches and uniformly simple heart-shaped leaves of leathery texture. This form usually occurs after the plant has climbed a tree, a fence or a wall. Propagations made from this adult growth are much more difficult to root than those made from the juvenile or vine form. They will, however, retain their adult characteristics and grow bush-like when planted alone. They will produce numerous round, globe-like inflorescences which are both interesting as flower designs and as heads of dark blue berry-type fruits. Not much is known of their ultimate size or age behaviour. Plants in the Garden four to five years old are only two to three feet in height.

PHOTO BY E.L.E.

English Ivy *Hedera helix*. Adult or bush-type growth.

Potted specimens for indoor, patio or porch use can be grown and trained to be satisfactory and interesting dark green foliage plants. They will thrive and grow under the exacting conditions of the hot dry air of our modern homes. They need strong light, but not direct sun, for best health. They must be kept moist, but not soggy wet, nor must they be allowed to stand in a saucer of water. An occasional washing off under a shower or a stiff spray from a hose will keep the leaves clean, free of spiders and mites and will keep the plant growing vigorously.

The Missouri Botanical Garden has pioneered in the field of providing a good hardy strain of ivy ground cover for the St. Louis region. The Bulgarian ivy, which Dr. Edgar Anderson selected after trials of ivies from many places, seems to be admirably suited to our colder winters and more especially to the hot dry months which are equally exacting for plant survival. The adult form of this ivy grown as a bush is also proving to be interesting and attractive to plant lovers.

E.L.E.

NEW CLIMATRON

PHOTO BY LEMOINE-SKINNER

The New Climatron which replaces the old Palm House is nearing completion with the framework now in place. Left to right, Buchmeister Fuller, Hugh Cutler, and Eugene Mackey. Photo November 1959.

TOWER GROVE

THE Henry Shaw Memorial Association, under the direction of Mr. John S. Lehmann, early in 1953 began restoration of Mr. Shaw's country home preparatory to opening it to the public. Mr. John Albury Bryan and the late Mr. Guy Study were the Architects in charge of restoration. The house, partly restored, was opened to the public in 1953, with the Eighth District Federation of Women's Clubs acting as hostesses. Mrs. Arthur J. Kreuger and Mrs. Geo. H. Pring, working with the Federation, have supplied hostesses on a volunteer basis for the past six years.

In 1954 much needed structural repair work was made possible by a substantial gift of money from Stix Baer and Fuller Company of St. Louis.

More recently, during the past year, work of restoration has been advanced through efforts of the Historical subcommittee of the Women's Association of the Garden together with Mr. Bryan, the Architect. Directly responsible and active in the work were Mrs. E. R. Culver, Jr., and Mrs. Neil Woods with consultation by Mrs. Fothergill Graves, Interior Decorator.

PHOTO BY LEMOINE-SKINNER

Hostess reception November 16, 1959, commemorating six years of volunteer service as hostesses in the Henry Shaw Home by members of the Eighth District Federation of Women's Clubs. Mrs. Walter H. Millan, the first volunteer hostess (seated), Mrs. Arthur J. Krueger and Mrs. Geo. H. Pring, who arrange for volunteer hostesses on a regular schedule, and second row, Mrs. L. P. Whiting and Mrs. Fred Steinkuhle.

ARCHEOLOGICAL CUCURBITS

Culture of man traced by his use of gourds, pumpkins and squash

DR. HUGH CUTLER, Executive Director of the Garden, has assembled one of the best collections of archeological cultivated plants in this country. Most of the items in the collection are corn, cucurbits and beans, but there are a great many specimens of other vegetable materials. For several years Dr. Cutler and I have been making a survey of the archeological cucurbits of North and South America, aided by a grant from the John Simon Guggenheim Memorial Foundation. The purpose of the survey is to trace the distribution of the cultivated cucurbits in time and space, linking their distribution with the migration and development of cultures.

The cucurbit materials recovered by archeologists from excavated sites usually consist of a number of charred, broken pieces of what was originally the rind of the fruit; some weather-beaten, eroded and decayed seeds; and a few battered peduncles (fruit stems), frequently riddled with insect tunnels. If accurately dated, a surprising amount of information can be gained from these bits of debris, in spite of its rubbish-like appearance. From a close examination of the rinds we can usually assign the material to the proper genus; i.e., either *Lagenaria* or *Cucurbita*. If the seeds are not too badly eroded or decayed, we can normally place them in the correct species. The peduncles can be readily identified by the expansion or flaring at the fruit attachment, by the angle and depth of the longitudinal ridges, and by the amount and texture of the corky enlargement. Some results already published indicate that *Cucurbita pepo* (summer squash, pumpkin, ornamental gourds) was being grown for food as long as 7000–9000 years ago.

In collaboration with a colleague, Dr. G. N. Davis, I am also preparing a manuscript on "The Botany, Cultivation and Uses of the Cultivated Cucurbitaceae." Consultations with Dr. Cutler and Dr. George B. Van Schaack, along with the rich collection of books in the Garden Library relating to the origin and early use of cultivated plants, have been helpful in advancing this project.

THOMAS W. WHITAKER
Geneticist
U. S. Department of Agriculture
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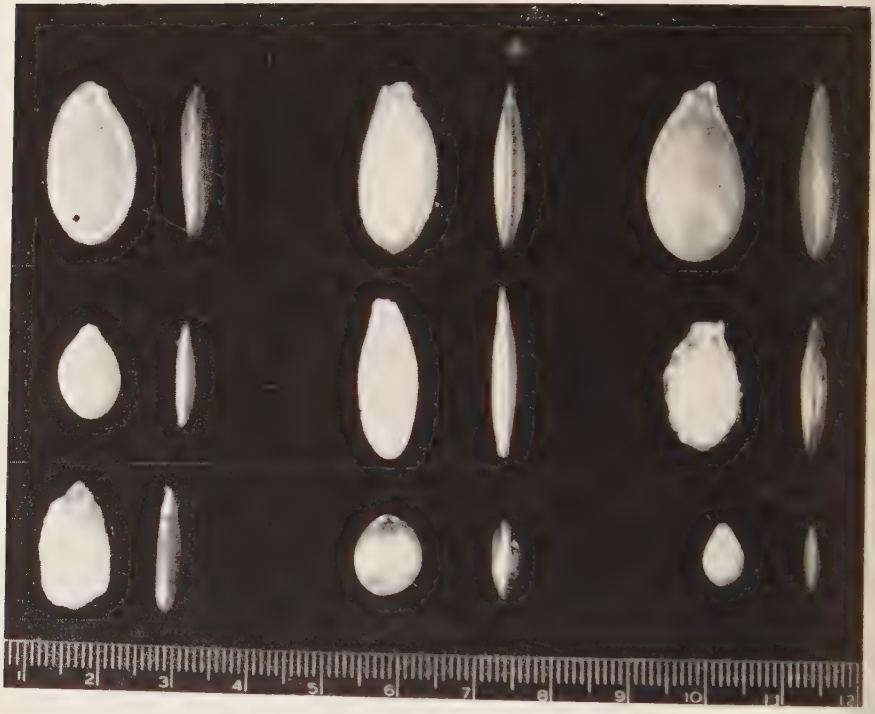

PHOTO BY T.W.W.

Fig. 1. The cucurbit seeds in the above illustration are representative of present day varieties. By comparing the gross morphology (form) with modern varieties, archeological cucurbit seeds can be identified with considerable precision.

Upper row left to right

Cucurbitas nixta var. *Lagenaria siceraria*; *C. moschata* (common); *C. moschata*

Center row left to right

Cucurbitas pepo (small); *C. pepo* (large); *C. moschata*

Lower row left to right

Lagenaria siceraria; *Apodanthera* sp., *Cucurbita foetidissima*

Apodanthera sp. and *C. foetidissima* are not cultivated plants but their seeds are occasionally found in vegetable material from archeological sites. The seeds of *Apodanthera* were used for food while the pulp and fibres of *C. foetidissima* were used in cleaning and scouring.

BOOK REVIEW

The Garden Flowers of China. By H. L. Li, Taxonomist of the Morris Arboretum and Associate Professor of Botany, University of Pennsylvania. The Ronald Press Company of New York. Copyright 1959. 231 pages. Price $6.50.

DR. LI in this book has brought together a comprehensive interesting presentation of China's contribution to horticulture. The bibliography is extensive and ranges over a period of nearly a thousand years. He gives a background of history, together with the lore and symbolism of many of what we consider "our" common garden flowers. The book is artfully illustrated with drawings and photo plates and would be most helpful if you were considering making a new garden, revamping an old one or if you wished to add something new. This is particularly true if you want to add an oriental flavor to your garden.

Much of the great joy of having a garden lies in the ability to know how to appreciate the flowers and to converse with your friends about the background, the culture and the use of these flowers, both in the garden and in arrangements. Dr. Li's book presents this lore and romance about many of the common garden flowers which originated in China in a modest readable fashion. The flower lovers will find the book fascinating to read as well as informative and helpful in making their gardens both attractive and personal.

E.L.E.

MISSOURI BOTANICAL GARDEN PROGRAMS

SPECIAL Shows and Displays in the Floral Display House:

Poinsettia Show, December 12, 1959, to January 15, 1960.

Orchid Show, January 23 to February 28, 1960.

Free nature programs for children, seven to ten and eleven to eighteen, are held every Saturday morning from 10:00 to 11:30 A. M.

Dead or Alive?	January 2
Winter Puzzles	January 9
Do You Have a Green Thumb?	January 16
Jungle Plants	January 23
The Green Thumb at Work (on your own plants)	January 30
The Mystery of the Orchid	February 6
Color Sound Movies	February 13
Plants in a Capsule	February 22
Three Cheers for the Green Thumb (you can take your plants home)	February 27

Free summer programs of nature study for children are supported by a gift from the Pitzman Foundation. Trails, craftwork and group activities are offered. Schedules for these programs may be obtained in June from the Main Gate.

Courses

The following courses are open to any interested person. Certificates are awarded upon successful completion of any course. Information on registration may be obtained by calling Prospect 6-5567.

Please send all registration fees to

Missouri Botanical Garden
2315 Tower Grove Ave.
St. Louis 10, Mo.

Registration fees cannot be refunded after the last day of registration for any particular course.

The courses will meet in the classroom of the Museum Building. To reach the Museum enter the Garden through the gate opposite Cleveland Ave. at 2221 Tower Grove Ave. The building on the left.

Grounds Care

Course 151. Area Management—For the landowner with one to fifty (or more) acres.

Place: Classroom, Museum Building

Time: Five Thursday nights in February (course given in alternate years. Next session 1961).

Fee: $15.00 for the five meetings

Enrollment: Limited to 20 students. Please register early.

A course specially designed for those having small acreages in the country. Principles of erosion control, control of weeds and brush, basic management of ponds and specialized management of meadows, marshes and forests for maximum recreation and enjoyment of wildlife will be explained and demonstrated. A course full of practical things you need to know. Instruction in agricultural crops and livestock care will not be included.

Horticulture

Course 121. Plant Propagation.

Place: Classroom, Museum Building. Practice work, Experimental Greenhouse.

Section I, Monday afternoons, 1:00 to 3:30 P. M., January 11 and 18.

Section II, Tuesday nights, 7:30 to 10:30 P. M., January 12 and 19.

Section III, Thursday mornings, 9:30 to 12:00 noon, January 14 and 21.

Section IV, Friday afternoons, 1:00 to 3:30 P. M., January 15 and 22.

Fee: $12.00 for two meetings.

Enrollment: Each section is limited to 25 students. Please register early.

Each period will include a lecture-discussion, followed by a student practice session.

The course will emphasize the following methods of vegetative propagation: root cuttings, suckers, divisions, hard and soft stem wood cuttings and leaf bud and scale propagations.

Student practice will emphasize propagation of house plants such as Begonias, Dieffenbachias, Philodendrons, etc. Some attention will also be given to hard wood cuttings.

Each student will be provided with one plastic covered propagating box and 40 to 50 kinds of cuttings.

Instructors: Clarence Barbre and Kenneth Peck.

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Robert J. Gillespie.....In charge of Orchids
Paul A. Kohl.....Floriculturist
Emmet J. Layton.....Landscape Architect
Virginia McMahon.....Library Secretary
Viktor Muehlenbachs.....Research Associate
Norton H. Nickerson.....Morphologist
Kenneth O. Peck.....In charge of Visitors' Activities
Isabella T. Powell.....Friends of the Garden Secretary
George H. Pring.....Superintendent
Kenneth A. Smith.....Engineer
Julian A. Steyermark.....Research Associate
Frank Steinberg.....Superintendent of the Arboretum, Gray Summit
George B. Van Schaack.....Librarian and Curator of Grasses
Trifon von Schrenk.....Associate Curator of the Museum
Robert E. Woodson, Jr.....Curator of Herbarium

SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. spring to fall and until six in the winter time though the greenhouses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four, admission fifty cents, with special guides. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one most used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southhampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 A. M., but is closed on Saturdays, Sundays, and holidays. The Cleveland Ave. gate, 2221 Tower Grove, is nearly always open, and there is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., adjacent to State Highways 50 and 66. It is open every day in the year and has auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi which are at their best in April.